

REMARKS

This paper is being provided in response to the Final Office Action dated January 20, 2006, for the above-referenced application. In this response, Applicants have cancelled claims 2, 4, 13 and 15 without prejudice or disclaimer of the subject matter thereof and have amended claims 1, 3, 6, 11 and 14 to clarify that which Applicants consider to be the invention. Specifically, Applicants have amended claim 1 to include the features of former claims 2 and 4 and have amended claim 11 to include the features of former claims 13 and 15. Applicants have also made corresponding amendments to claim 6. Claims 3 and 14 have been amended to modify dependencies according to the amendments made herein. Applicants respectfully submit that the amendments to the claims are fully supported by the originally-filed application.

The rejection of claims 1, 2, 3, 5-8, 10-14 and 16 under 35 U.S.C. 103(a) as being unpatentable over JP Patent No. 4-35107 to Morita et al. (hereinafter "Morita") in view of JP. 2001-110264 to Satoshi et al (hereinafter "Satoshi") and the rejection of claims 4 and 15 under 35 U.S.C. 103(a) as being unpatentable over Morita in view of Satoshi and further in view of JP 2001-237665 assigned to Nippon (hereinafter "Nippon") are hereby traversed and reconsideration is respectfully requested. As noted above, Applicants have amended herein independent claims 1 and 11 to include the features of claims 4 and 15 and have made corresponding amendments to independent claim 6.

Independent claim 1, as amended herein, recites a crystal unit that includes a crystal blank having a hole portion defined in at least one principal surface thereof, providing a vibrating region in a portion of the crystal blank which is made thinner by the hole portion, excitation

electrodes disposed respectively on opposite principal surfaces of the crystal blank in the vibrating region, extension electrodes extending respectively from the excitation electrodes to respective first and second positions on an outer peripheral portion of the crystal blank, a casing, and a pillow member mounted on the casing. Further, the crystal blank has a single fixed end electrically and mechanically connected to the casing by eutectic alloy in the first position, said crystal blank has a free end in said second position, the free end being placed on said pillow member, and the extension electrodes are electrically connected to the casing by wire bonding in the second position. Claims 3 and 9 depend from independent claim 1.

Independent claim 6, as amended herein, recites a structure for holding a crystal blank having a hole portion defined in at least one principal surface thereof, providing a vibrating region in a portion of the crystal blank which is made thinner by the hole portion. The crystal blank supports thereon excitation electrodes disposed respectively on opposite principal surfaces of the crystal blank in said vibrating region, and extension electrodes extend respectively from the excitation electrodes to respective first and second positions on an outer peripheral portion of the crystal blank. The crystal blank has a single fixed end electrically and mechanically connected to a holder by eutectic alloy in the first position and the crystal blank has a free end on which wire bonding wires are connected to the extension electrodes in the second position, the free end being disposed on a pillow member mounted on the casing. Claims 7 and 8 depend directly or indirectly from claim 6.

Independent claim 11, as amended herein, recites a crystal unit that includes a crystal blank having a hole portion defined in at least one principal surface thereof, providing a vibrating

region in a portion of the crystal blank which is made thinner by the hole portion, excitation electrodes disposed respectively on opposite principal surfaces of the crystal blank in the vibrating region, extension electrodes extending respectively from the excitation electrodes to respective first and second positions on an outer peripheral portion of the crystal blank, a casing, and a pillow member mounted on the casing. Further, the crystal blank has a single fixed end electrically and mechanically connected to the casing by eutectic alloy in the first position, said crystal blank has a free end in said second position, the free end being placed on said pillow member. Claims 12, 14 and 16 depend directly or indirectly from independent claim 11.

The Morita reference discloses a crystal block (14) having a recessed part (15) formed in the middle thereof to provide ridges (17) around the circumference of the crystal block (14). The Office Action states that Morita does not disclose eutectic bonding.

The Satoshi reference discloses a crystal oscillator that is produced by bonding holding crystal on both principal surfaces of an oscillator crystal. Satoshi discloses that the eutectic alloys are formed and laminated on the outer circumference of both principal surfaces of the oscillator crystal and the outer circumference of the holding crystal opposite to the oscillator crystal. The Office Action states that Satoshi does not disclose a second end of the crystal blank connected to the casing by wire bonding, a free end of the crystal blank and does not define a cut for the crystal.

The Nippon reference discloses a surface mounting container for crystal resonator that has a pillow section to maintain crystal at specific level with respect to opposite ends of

container base. The Office Action cites Nippon as disclosing a pillow member (6) mounted on the casing, a free end of the crystal blank being placed on the pillow member (6). The Office Action states that Nippon does not show a hole portion defined in at least one principal surface thereof or wire bonding.

Applicants have described in the present specification (see, for example, page 4, lines 1 to 22) that when a crystal blank is fixed to a casing by way of the eutectic alloy at two points, the crystal blank is strained due to the difference between the coefficient of thermal expansion of the crystal blank and the casing. The strain is propagated to the vibrating region of the crystal blank, impairing the vibrating characteristics of the crystal blank, in particular, frequency vs. temperature characteristics that will be represented by a cubic function curve if the crystal blank comprises an AT-cut quartz crystal blank. Accordingly, in order to reduce the strain due to the difference in the thermal expansion coefficients, the present claimed invention provides a crystal blank having a fixed end that is fixed to the casing at a single point by eutectic alloy and a free end that is placed on a pillow member mounted on to the casing. Since the crystal blank is rigidly fixed to the casing at a single point, the strain due to the difference in thermal expansion coefficient between the crystal blank and the casing is minimized, and the pillow member at the position of the free end of the crystal blank facilitates the wire bonding operation to the crystal blank.

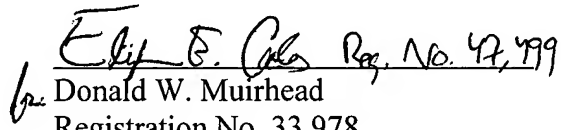
The Office Action cites Nippon as disclosing a pillow member as recited by Applicants that may be combined with the Morita and Satoshi to render as unpatentable Applicants' presently claimed invention. However, the Office Action states that Nippon does not disclose

wire bonding operations and structurally does not disclose a hole portion defined in at least one principal surface of the crystal blank that is recited by Applicant as providing a vibrating region in the crystal blank. Further, the Office Action states that Satoshi does not disclose wire bonding and that Morita does not disclose eutectic bonding. Finally, Applicants submit that none of the cited references are directed to the problem addressed by the present claimed invention concerning the straining from thermal expansion differentials of a crystal blank bonded to a case by a eutectic alloy. Accordingly, Applicants respectfully submit that there is no motivation to combine the Morita, Satoshi and Nippon references to obtain Applicants' presently claimed invention. The references are each directed to different issues concerning crystal oscillation and different bonding techniques and none of them directly address the long felt need identified and characterized by Applicants involving strain problems resulting from bonding of crystal blanks to cases with eutectic alloys, as noted in detail above. Applicants submit that in view of the disparate teachings of these references, one of ordinary skill in the art would not look to combine these references in the manner as suggested by the Office Action to obtain Applicants presently claimed invention. In view of the above, Applicants respectfully request that this rejection be reconsidered and withdrawn.

Based on the above, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 508-898-8603.

Respectfully submitted,
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